

MAGNETOSPHERES OF THE OUTER PLANETS

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Jupiter's Ultraviolet Aurora from Galileo Ultraviolet Spectrometer Observations

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Abstract. The Galileo ultraviolet spectrometer (UVS) obtained bright northern auroral spectra of Jupiter's night side during orbit Ganymede-7 on April 2, 1997. H₂ band emissions were observed in the far-ultraviolet (FUV, 115-162 nm), and middle-ultraviolet (MUV, 162-323 nm). FUV emissions of 2200 kR due to the H₂ Werner and Lyman bands were seen from 115-162 nm. MUV emissions due to the H₂ a $^3\Sigma_g^+$ - b $^3\Sigma_u^+$ continuum of 300 kR were seen from 162-323 nm. Coordinated Galileo Solid State Imager (SSI) observations found northern night-side auroral emissions on a narrow ~200 km wide arc in several filters, including violet (Ingersoll et al., 1998). Calibrated laboratory spectra of electron-impact induced emissions of molecular hydrogen obtained from 175-530 nm (James et al., 1998) overlap the wavelength ranges of the SSI violet filter and the UVS. The SSI violet (385-430 nm) brightness of ~50 kR, compared to the UVS FUV and MUV brightness, is consistent with production of the SSI violet emissions by electron bombardment of H₂ gas. An auroral atmosphere model (Gladstone et al., 1998) combined with a Chapman auroral excitation profile and methane and acetylene absorption is used to build model FUV spectra. Varying the auroral altitude to fit the UVS G7 FUV spectrum leads to an estimate of auroral altitude of ~275-295 km, slightly higher than the SSI derived auroral altitude from G7 of 245±130 km. Comparison with a detailed electron transport model shows that the full-width at half-maximum (FWHM) of the aurora is in better agreement with the G7 data than the single Chapman layer. The detailed electron transport model also provides better agreement with the observed FUV/MUV band ratios than a cold secondary electron distribution from Opal et al., 1971. However, the detailed model places the auroral emission peak at 250 km, somewhat below our estimate of 275-295 km for the G7 northern aurora.